

of his mental development, have greatly tended to form and strengthen his intellectual character. The fact is, Dalton was a born teacher, and, luckily for the world, he realised his true vocation. He then joined his elder brother Jonathan in carrying on Mr. Bewley's school at Kendal, and for twelve years he instructed the youth of both sexes in English, Latin, Greek, and French; writing, arithmetic, merchants' accounts, and the mathematics. It is interesting to trace, from the school syllabus issued by the brothers, how John was gradually drawn to the study of science, first to the oldest of all the sciences, astronomy, and then to the various branches of physics, or natural philosophy, as it was then termed. The late Prof. Huxley used to say to his colleagues, "If you want to get up a subject, offer to lecture upon it," and Dalton would seem, in practice, to have acted upon this principle. The school syllabus was gradually enlarged until, as Sir Henry Roscoe says, it "forcibly reminds us of that of a technical school of the present day."

When twenty-seven years of age, John Dalton accepted the position of tutor in mathematics and natural philosophy at the Manchester Academy, and for upwards of fifty years Manchester continued to be his home until his death at the age of seventy-eight.

For some years prior to his removal to Manchester Dalton had offered to give public lectures, and the Manchester Literary and Philosophical Society possesses copies of the prospectus he issued for courses on natural philosophy to be held at Kendal—"Admittance 6d. each lecture, or 5s. the whole." After his removal to Manchester he again arranged for a course at Kendal "as far as the apparatus there would admit"—"about six lectures on chemistry and six on the other branches would be my plan." Tickets for the course to admit a gentleman and lady, or two ladies, 10s. 6d.; single lectures, 1s. 6d.

Dalton was now fully embarked on the career of a public lecturer on science, and until he was close upon seventy years of age there were few years in which he was not called upon to give courses. At the instigation of Davy he was early invited to London—Albemarle Street sharing with Athens a passion for the newest thing—to receive from the youthful *protégé* of Rumford, himself some twelve years Dalton's junior, instruction in declamation, and in the art and mystery of holding the attention of a Royal Institution audience.

In the publication before us Dalton's later career as a science lecturer is succinctly set forth. He repeated his London lectures in Manchester. "In a populous town like this, where the arts and manufactures are so intimately connected with various branches of science, it may be presumed that public encouragement will not be wanting to a person qualified to exhibit and illustrate the truths of experimental philosophy upon a liberal and extensive scale." Nor was it. John wrote to Jonathan that "a more respectable audience has seldom been had on a similar occasion." In 1807 he was invited to Edinburgh, and subsequently to Glasgow, where, as he says, "he was honoured

with the attention of gentlemen, universally acknowledged to be of the first respectability for their scientific attainments, most of whom were pleased to express their desire to see the publication of the doctrine." The "doctrine" thus indicated took the shape of that epoch-making work, "A New System of Chemical Philosophy," part i. of which appeared in the following year.

Although the greater number of Dalton's public lectures were given in Manchester, at the rooms of the Literary and Philosophical Society, of which he became the honoured president, or at Thomas Turner's Medical School in Pine Street, or at the Royal Manchester Institution, or at the Mechanics' Institution, where he gave his last lecture, in 1835, on the Atomic Theory, he was readily induced, until age and physical infirmity began to tell upon him, to visit the neighbouring towns, and Leeds and Birmingham were in turn favoured with his presence. All that can be ascertained respecting these various courses, and especially of the diagrams and illustrations used by Dalton in connection with them, most of which seem to have been prepared by himself, is set forth in the interesting account before us. The diagrams, 150 in number, are the property of the Manchester Literary and Philosophical Society, and Prof. Haldane Gee, and Drs. Coward and Harden have done a signal service to the history of one of the most remarkable epochs in science in giving a description of the more important of them, and of the circumstances under which they were first employed by their illustrious author.

T. E. THORPE.

PROF. RAPHAEL MELDOLA, F.R.S.

SCIENCE and the world are alike the poorer by the sudden death of Prof. Meldola on Tuesday, November 16. Naturalist, chemist, physicist, and man of affairs, it is no easy matter to estimate, thus near to that sad event, the value of his work and influence. But we may recall the facts that at the time of his death he had been for thirty years professor of chemistry at the Technical College, Finsbury, a part of the City and Guilds of London Institute, that he was also a vice-president of the Royal Society, a member of the Advisory Council appointed by the Privy Council to promote scientific research in relation to trade and industry, and chairman of the Advisory Council of the Board of British Dyes (Ltd.), a commercial organisation fostered by Government to assist in the manufacture of dyestuffs in the United Kingdom.

Raphael Meldola was the only son of the late Samuel Meldola, and was born in Islington July 19, 1849. They came of an ancient Sephardic family, the Sephardis being Spanish and Portuguese Jews, the more aristocratic section of the race. The genealogy of the Meldolas can be traced through sixteen generations without a break, back to Isaiah Meldola (b. 1282, d. 1340), of Toledo. Under Spanish names the family flourished long in Toledo, and produced many men of

note and learning. The name Meldola seems to have been assumed from the place of that name not far from Ravenna, when some of the family established themselves in Italy. The earlier members of the family for many generations were the Chief Rabbis of their communities.

Raphael Meldola was educated in private schools and the Royal College of Chemistry. At a very early age he was for a time in the private research laboratory carried on by Dr. John Stenhouse, F.R.S., and after two years in a colour works at Brentford, he joined, in 1872, the teaching staff of the Royal College of Science under Prof. Frankland. His training, therefore, had been chemical, but it is interesting to notice how his inclinations often led him in other directions, for the first seven papers under his name in the Royal Society catalogue all relate to subjects of natural history, especially in connection with mimicry and protective colouring in insects. This interest he always maintained, and he was twice president of the Essex Field Club (1880-83 and 1901-2), and later president of the Entomological Society in 1895-97.

While still at South Kensington he assisted Sir Norman Lockyer in spectroscopic work in the Solar Physics Laboratory, and in 1875 was placed in charge of the British Eclipse Expedition to the Nicobar Islands in the Bay of Bengal.

By the outer world, however, Meldola has always been thought of chiefly as a chemist specially familiar with the chemistry of colouring matters. His first paper on a chemical subject was, in fact, a "Preliminary Notice of a New Yellow Colouring Matter," published in 1878. This was followed immediately by studies in the naphthalene series, and three years later he announced a "New Class of Colouring Matters from the Phenols" in the Transactions of the Chemical Society (1881). In the meantime he had joined the firm of Messrs. Brooke, Simpson, and Spiller, in whose works at Hackney Wick he remained eight years, and where he made important practical discoveries, including the dye known in Germany as Meldola's blue. While at Hackney he was associated with the late Mr. R. J. Friswell and with Prof. A. G. Green, now of Leeds University, with whom he retained a close friendship, and from whose competent pen we may expect to receive before long a full account of Meldola's technical as well as scientific colour researches.

In 1885 Meldola was appointed to the chair of chemistry in the Technical College, Finsbury, and there he taught many generations of students, in the list of whom are to be found the names of Profs. Forster, Morgan, and W. J. Pope, all fellows of the Royal Society, besides many others well known in the teaching or industrial worlds.

As to his work at Finsbury, Prof. Silvanus Thompson, Principal of the college, writes as follows:—"Meldola was invaluable to his colleagues as a wise adviser, a steady, constant, and loyal colleague. He used, however, to complain privately of the considerable proportion of his

time which was taken up by correspondence with his students, and with writing testimonials for them, but he never stinted the time or pains he took to respond to appeals for this kind of help. The quantity of work he got through during the last twelve months, and more, is to me simply amazing, and this in spite of the severe illness (involving a surgical operation) of last spring. And he wrote long letters from Bournemouth and elsewhere on details of laboratory organisation and questions of staff arrangements, etc., with minute care. We had many long country walks together, and thus, apart from my daily intercourse with him for thirty years, I had the fullest opportunities of knowing what a richly-stored mind he had, and what a noble simplicity and sincerity of nature was his."

To this testimony, which will be most heartily confirmed by his many other friends, it should be added that while Meldola was by nature a most amiable man, in demeanour modest and undemonstrative, he was a very competent chairman, clear in his judgment, firm when necessary, at the same time full of tact.

Meldola served many societies. In addition to those already mentioned he was president of the Chemical Society (1905-7), of the Society of Dyers and Colorists (1907-8), of the Society of Chemical Industry (1908-9), and of the Institute of Chemistry (1912-15). These offices gave opportunities for the expression of his views about such important public questions as the relation of science to industry and the necessity for research.

"We must take," he says in one place, "a broad, an imperial view of original research if we desire, as we all do, to influence the public mind. Every discovery emanating from your laboratories not only helps to extend the boundaries of our science, but it helps also to uphold the general principle that original research is in itself, and by itself, the most powerful weapon that has been or ever can be wielded by mankind in struggling with the great problems which nature offers on all sides for solution."

Nor must be forgotten the numerous occasions on which Meldola pointed out the cause of the departure of the coal-tar colour industry from this country, where it originated, and warned the British public of what would probably ensue if the indifference prevalent among manufacturers continued to exist in this country. These warnings remained practically unheeded till the outbreak of war forced into prominence the unpleasant fact that this country was destitute of dyes, drugs, and all chemicals of the finer sort. When the history of these times comes to be written Meldola will not be forgotten.

Space does not allow us to do more than recall the active interest he took in biological problems, as indicated by his translation of Weismann's "Theory of Descent" (1882-83) and by his own work on mimicry in insects already mentioned, but it is to be hoped that a full estimate of the value of his researches in this direction will be provided by some of his biological friends.

Among the honours conferred on Prof. Meldola were the honorary degrees of D.Sc. Oxon.,

LL.D. St. Andrews, and in 1913 the Davy Medal of the Royal Society. He was also elected a member of the Athenæum Club under Rule ii. He was president of the Maccabæans in 1911. In 1886 he married a daughter of the late Dr. Maurice Davis, J.P., who survives him.

W. A. T.

Raphael Meldola occupied a unique position. In an age of ever-increasing specialisation he kept alive and fresh every one of the diverse interests that had appealed throughout his life to his many-sided intellect: by sure scientific insight he spoke with authority on them all. What scientific man of our time could have brought out in a single year three memoirs dealing with subjects so far removed from one another as the following?—

"Contributions to the Chemical History of the Aromatic Derivatives of Methane" (*Trans. Chem. Soc.*, May, 1882); "Mimicry between Butterflies of Protected Genera" (*Ann. Mag. Nat. Hist.*, December); "Preliminary Report of the Committee appointed to investigate the Ancient Earthwork in Epping Forest known as the Loughton Camp" (*Report Brit. Assoc.*, 1882, p. 274).

Apart from his researches in organic chemistry, and his work on natural history, Meldola conducted and wrote the report on the Eclipse Expedition to the Nicobar Islands (1875); founded the Epping Forest and County of Essex Naturalists' Field Club, laying down in the inaugural address (1880) the policy and lines of work which have made this society one of the best in existence, gave in the coming-of-age address a *résumé* of all that had been accomplished; wrote, with his friend, William White, the first volume of special memoirs of the club—an account of the East Anglian earthquake of April 22, 1884; took a leading part in founding the Corresponding Societies of the British Association (1883); defended the "scientific use of the imagination" in the study of insects in his first presidential address to the Entomological Society of London (1896); considered the part played by physiological correlation in the utility of specific characters in his second address; delivered the Herbert Spencer lecture at Oxford on "Evolution, Darwinian and Spencerian" (1910).

Meldola was naturally brought, by the immense breadth of his interest, into intimate association with the leaders in all branches of science. Hence, with his well-known unselfishness and warm-hearted appreciation of good work of every sort, he was often applied to for help, and took a prominent part in movements for the recognition of important researches, or for preserving the memory of great men. This and the public work—especially in connection with scientific and technical education and industry in its relations with science—he was constantly called on to perform, cut deeply into his limited time and his strength, which was never great.

Natural history was his first love. He began to write papers, especially dealing with British insects, in 1868, six years before his first chemical research was published. The necessities of space

forbid anything more than a brief account of his principal work—the development of the theories of insect mimicry and allied subjects. In this he was encouraged by Charles Darwin, who sent him letters received from Fritz Müller in Brazil, and suggested the translation of Weismann's "Studies in the Theory of Descent" (1881-2). Thus it came about that Fritz Müller's work and the theory of Müllerian mimicry became known in this country almost as soon as in Germany, and penetrated the world through more important and far-reaching channels. These and Meldola's own researches, published in several memoirs, together with his translation of Weismann, greatly enriched by his editorial notes, erected, upon the foundation supplied by Bates and Wallace, the peculiarly British study of the bionomic value of colour, marking, and attitude in nature.

Meldola always spoke with the greatest enthusiasm of his association with Darwin and his visits to Downe. He had the distinction of being proposed by Charles Darwin as a candidate for the fellowship of the Royal Society. Among Meldola's warmest friends were Wallace, Bates, and Trimen, his seniors in the important department of evolution that he made his own. Those who came later and attempted to confirm and extend his work can never forget the encouragement they owe to his constant sympathy and help.

The present writer feels the inadequacy of this brief notice, and regrets that in the allotted space it was impossible to prevent it from bearing the appearance of a list.

In the future period of reconstruction Meldola's many-sided activities and devotion to science would have been a precious asset to the nation; but in this sad hour the loss that presses most heavily is that of a dear friend and brother in science.

E. B. P.

DR. H. CHARLTON BASTIAN, F.R.S.

BY the death of Dr. Charlton Bastian on November 17, the last of a distinguished band of men of science, which numbered among its members Pasteur, Darwin, Huxley, and Tyndall, has passed away.

Born at Truro in 1837, Dr. Bastian was educated at University College and Hospital, London, and graduated M.A. in 1861 and M.D. in 1866 in the University of London. His first appointments were those of lecturer on pathology and assistant physician at St. Mary's Hospital; these posts he held until 1867, when he was elected professor of pathological anatomy in University College Hospital. He afterwards became physician to this hospital, and in 1887 professor of the principles and practice of medicine there.

Dr. Bastian devoted minute and prolonged study to the nature and functions of the brain and nervous system. He was a recognised authority on nervous affections, and was for some years physician to the National Hospital for Paralysis and Epilepsy, as well as being a Crown referee in cases of supposed insanity. His best known